Society of Irish Plant Pathologists
&
Entomology Society Ireland
present:

Future Plant Health Responders Meeting 2024

25th October 2024

Meeting Topics

- Climate driven pests and pathogens
- Crop protection and pest managment
- Pathology and Entomology

Guest Speakers

- Pádraig Flattery from Met Éireann
- Andy Bourke from Pest Risk Analysis Unit, DAFM

Abstract Submisson

Submit by the 6th of October abstracts to:
studententosocireland@gmail.com &
sippsecretary@gmail.com

Tickets:
€15

Hosted at Teagasc Oak Park
Cereals Building, Conference Centre
Carlow R93 XE12

Timetable:

Time	Speaker	Topic
10:00	**Registration/coffee**	
Session 1 Chair: Anna Tiley		
10:30	Ewen Mullins	Welcome
10:40	Invited Speaker: Met Éireann	Pádraig Flattery
11:00	Invited Speaker: DAFM	Andy Bourke
11:20	Questions/Discussion	
Session 2 Chair: Maximillian Schughart		
11:30	Virgile Ballandras	Identifying various aphid species from bulk insect samples using COI metabarcoding
11:45	Rabisa Zia	Multiplex Digital Droplet PCR Assay for the Detection of Barley Pathogens
12:00	Karuna Shrestha	In-vitro Micropropagation of Ash Dieback-tolerant *Fraxinus excelsior* Genotypes
12:15	**Lunch & posters**	
Session 3 Chair: Aisling Moffat		
13:30	Discussion session chaired by Aisling Moffat	
Session 4 Chair: Tomas Byrne		
14:00	Daniela Costa	Can silicon-based biostimulants help reducing pesticide use in strawberry production?
14:15	Jack Perry	Comparing aphid monitoring tools for BYDV, what we've learnt after year one.
14:30	Paul Brett	Developing an Online Tool to Forecast high priority plant pests for Ireland
14:45	Laura Guillardin	Assessing the impact of *P. ramorum* to hybrid larch trees in Ireland
15:00	**Coffee break**	
Session 5 Chair: Virgile Ballandras		
15:15	Marta Niedzicka	Using HTS to understand viral diversity in crops and potential viral reservoirs
15:30	Maximillian Schughart	Identifying the impact of insecticide resistant grain aphids (*Sitobion avenae*) on barley yellow dwarf virus epidemiology in Ireland
15:45	Ultan Ó'Donnell	Our History in Pests: Rescuing Data To Help Understand Ireland's Forestry Pests
16:00	SIPP AGM	

Keynote Talk

Pádraig Flattery

Met Éireann 65/67 Glasnevin Hill, Dublin 9, D09 Y921, Ireland

Ireland's climate is changing, between 1961-1990 and 1991-2020, the country warmed by 0.7°C and became 7% wetter. These shifts are driven by global climate change caused by the emission of anthropogenic greenhouse gases contributing to the enhanced greenhouse effect. Storms from October 2023 to March 2024 produced 20% more intense rainfall, and increased precipitation associated with storms now 10 times more likely due to rising global temperatures. As the climate warms, the atmosphere holds more moisture, leading to heavier rainfall, prolonged wet periods, and increased likelihood of extreme weather events, including droughts and heatwaves.

Ireland's temperate maritime climate, influenced by its location in the northeast Atlantic, typically results in mild winters and cool summers. However, this typically predictable weather pattern is shifting. As global temperatures rise, Ireland will face more erratic weather, posing challenges to agriculture, infrastructure, and ecosystems. The TRANSLATE project, led by Met Éireann, is Ireland's first national climate projection initiative. It forecasts drier summers, wetter winters, more intense precipitation, and growing seasons starting earlier and lasting longer.

These changes will affect plant health, particularly as pests and diseases may thrive under new conditions. As global temperatures increase, warmer and wetter conditions will alter plant-pathogen interactions and pest lifecycles. Understanding these shifts is crucial for preparing future plant health responders, requiring a multidisciplinary effort involving plant pathologists, entomologists, and climate scientists. Future impacts on Ireland’s plant health sector depend largely on global emissions reduction efforts, as more severe changes are expected with higher warming scenarios.

Evolution of Pest Risk Analysis (PRA) on plant pests in Ireland

Andy Bourke[a]

[a] *Department of Agriculture Food and the Marine, Celbridge, Co. Kildare, Ireland.*

Pest Risk Analysis (PRA) in Ireland has advanced significantly to tackle emerging plant health threats. This presentation will cover key milestones and the timeline leading to the establishment of the Department of Agriculture, Food, and the Marine's (DAFM) dedicated Pest Risk Analysis Unit (PRAU), while highlighting current progress and future directions. To date, over twenty PRAs have been completed, with six published online. Active collaborations with EU and international organisations have strengthened Ireland's PRA capabilities. Looking ahead, the focus will be on integrating climate models and new research into the PRA process, that will help to address increasing pest threats driven by climate change, rising trade volumes, and new trade routes.

A significant PRAU task on assessing the risks to Ireland posed by EU quarantine pests under Regulation 2072/2019 will be highlighted. To comply with EU legislation, Ireland must conduct multi-annual pest surveillance, unless it's proven that pests cannot survive in Ireland's climate or lack suitable hosts. Using this opportunity, PRAU developed a national pest risk register, aligning it with surveillance activities and inspector training. This initiative aims to enhance inspection efficiency, focus on high-risk pests, establish a public database, and provide pest identification booklets for field inspectors. Additionally, it aligns with the EU's shift from pest-specific surveys to crop-specific surveys and the integration of more risk-based surveys.

Identifying various aphid species from bulk insect samples using COI metabarcoding

Virgile Ballandras, Louise McNamara, Marta Niedzicka, James Carolan and Stephen Byrne

Aphid-monitoring programs still rely on morphological identification of aphids by taxonomic experts. Sorting samples collected in suction towers and morphological identification is a laborious process that relies on taxonomic expertise. This restricts the amount of samples that can be feasibly processed in a timely manner.

The current trend in the scientific community who deal with large amounts of insect's bulk samples is to develop and utilise molecular tools to support identification.

Our goal is to develop a metabarcoding assay that will identify aphids in bulk samples and complete the collection of diagnostic tools developed in the RapID-Pest project. As a starting point, we selected 19 species of aphid found in Ireland and which are known to transmit viruses to a wide variety of crops. A challenge in DNA metabarcoding is designing appropriate primers that do not introduce bias. Sequencing mitochondrial genomes from vouched specimens can support the development of DNA metabarcoding primers appropriate for the target species.

We therefore created a reference library for each target species composed of the whole genome associated with a collection of high definition images of all the insects contributing to the DNA isolations. This allowed us to create a set of primers that will allow us to detect these species systematically in samples.

We intend to use the Oxford Nanopore Technology MinION sequencing device and its ability to sequence long reads at limited costs in order to increase the discriminative power of the molecular markers compared to previously published metabarcoding assays.

Multiplex Digital Droplet PCR Assay for the Detection of Barley Pathogens

RABISA ZIA[1,2], ZOË A. POPPER[2] AND STEVEN KILDEA[1]

[1]Teagasc, The Agriculture and Food Development Authority, Carlow, Ireland and [2] Botany and Plant Science and Martin Ryan Institute, School of Natural Sciences, College of Science and Engineering, University of Galway, Ireland

Barley is most widely grown cereal crop in Ireland and 2nd most important crop in the UK. However, the crop faces substantial yield losses *annually* due to airborne, seed-borne, and soil-borne pathogens*. Ramularia Leaf Spot, leaf scald and net blotch, caused by Ramularia collo-cygni (Rcc), Rhynchosporium commune and Pyrenophora teres respectively, are three important disease of barley, responsible for up to 40% yield loss in Europe annually. Owing to the seed borne nature of these diseases, seed screening is* hugely important for pest management and to prevent transboundary spread of pathogens*.* Digital droplet PCR (ddPCR) i*s a third generation of quantitative PCR, relying on sample partition into thousands of droplets with each droplet acting as a reaction unit, enabling the precise detection of DNA sequences.* Here we demonstrate the combination of two ddPCR assay for the detection of above mentioned pathogens. In the first assay, a multiplex ddPCR assay, provides the capacity to detect *R. commune, Rcc and P. teres in a single reaction. Samples positive for P. teres, are further analysed in a subsequent assay to distinguish between two forms of P. teres i.e. P. teres f. maculata (Ptm) and P. teres f. teres (Ptt) causative agents of net and spot form of net blotch respectively. The assay relies on conventional TaqMan probe chemistry providing highly specific and sensitive detection of the pathogens. In order to validate the specificity of the assay, the system was challenged with various barley pathogens. Additionally, the efficiency of the assay was demonstrated by testing historical seed samples of winter and spring barley varieties* with variable susceptibility to the different diseases.

In-vitro Micropropagation of Ash Dieback-tolerant _Fraxinus excelsior_ Genotypes

Karuna Shrestha[1,2], Oliver Gailing[2], Dheeraj Singh Rathore[1]

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Ash dieback (ADB) disease, caused by the ascomycete fungus *Hymenoscyphus fraxineus*, is a severe and widespread disease that has resulted in extensive damage to the ash population (*Fraxinus excelsior*) across Europe. In Ireland, the disease was first detected in 2012. Symptoms include necrotic lesions, crown defoliation, leaf wilting, and, in severe cases, tree death. The rapid spread of ADB threatens the survival of common ash, making it crucial to develop effective methods for propagating ADB-tolerant ash genotypes.

This study aims to establish an efficient *in-vitro* micropropagation protocol using indirect organogenesis to regenerate ash seedlings from selected tolerant genotypes. Seeds were collected from the tolerant trees in the Teagasc gene bank, and the immature zygotic embryos were extracted as explants. These embryos were cultured in a media supplemented with various combinations and concentrations of cytokinins (treatments=5) and auxins (treatments=6), to determine the optimal conditions for higher regeneration frequency of ash plantlets.

Preliminary results indicate that specific hormone combinations (1:3 ratio of cytokinin A to auxin B) enhance the regeneration of healthy plantlets (n=6.9 average number of plantlets per explant). More genotypes tolerant to ADB are being tested, with a goal of developing a genotype-independent micropropagation protocol. This protocol will support the long-term goal of establishing seed orchards from the propagated tolerant genotypes, aiding in the restoration of tolerant ash population in Ireland.

Can silicon-based biostimulants help reducing pesticide use in strawberry production?

Daniela Costa[1*], Orla O'Halloran[1], Anthony Gargan[1, 2], Zoia Arshad Awan[1], Michael T. Gaffney[1], Lael Walsh[1]

[1] *Teagasc – Agriculture and Food Development Authority, Horticulture Development Department, Ashtown, Dublin 15, Ireland, D15KN3K*

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Pesticides are commonly used in agriculture to protect crops from pests and diseases, but their usage is linked to harmful effects on both the environment and human health. The EU has set a target to reduce the use and risks of chemical pesticides by 50% by 2030. It is crucial to explore more sustainable alternatives as this reduction raises concerns about potential decreases in production yields and food security. Biostimulants may offer a promising solution by working synergistically to enhance crop defence against diseases. Among these, silicon-based biostimulants (Si-bio) present a viable option for promoting more sustainable food production. Commercial Si-bio formulations are already available, with reports suggesting their ability to lower disease pressure. In strawberry crops, Si-bio has been shown to improve plant growth and enhance certain fruit quality traits. Nevertheless, research on silicon in strawberry production, particularly its impact on disease development at a commercial scale, remains limited. In this study, we investigated the effects of two Si-bio on strawberry production and disease development (glasshouse and polytunnel trials). Si-bio plots were compared to untreated controls and those treated with a standard pesticide program in Ireland, using a randomized design. One trial investigated the combined use of Si-Bio and reduced pesticide programme. Overall, findings indicate a limited effect of Si-bio on strawberry fruit production and disease (pesticides more efficient controlling disease development). However, some quality parameters improved which can favour shelf-life extension. This work will expand understanding of the effectiveness of these biostimulants in strawberry production and disease management.

Comparing aphid monitoring tools for BYDV, what we've learnt after year one.

Jack Perry, Liam Sheppard, Joe Roberts, Tom Pope, Stephen Byrne and Louise McNamara.

Aphids reduce grain yield and quality in cereal crops via direct feeding and vectoring viruses. The most economically important aphid vectored virus in cereals is barley yellow dwarf virus (BYDV), which can cause up to 80% yield losses. Managing aphids is becoming increasingly challenging due to (i) reduced insecticide availability, (ii) insecticide resistance, (ii) lack of robust thresholds and (iv) climate change. Navigating these challenges requires robust monitoring programmes that account for both the spatial and temporal distribution of aphids.

We have established a multi-year national aphid-trapping programme in Ireland, to validate the use of different monitoring tools (suction tower network, in-field water traps and in-field aphid searches) to forecast aphid populations and BYDV outbreaks. All aphids captured with the monitoring tools are tested for BYDV, alongside leaf samples collected from barley crops. The first year of this study has been completed and includes data from three suction towers and 18 winter barley crops across Ireland. Our results from year one provide initial insights into the species of aphids and incidence of BYDV-infected aphids present in Ireland using different monitoring tools and how this links to BYDV incidence with barley crops.

Developing an Online Tool to Forecast high priority plant pests for Ireland

Paul Brett[1], Jon Yearsley[1] , Tamara Hochstrasser[1] , Klara Finkele [2] , Padraig Flattery [2], Barry Coonan [2], Deborah Hemming [3], Conor McGee [4]

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The OPRAM project is developing an open source web application, which will be used in guiding risk assessment and surveillance of high priority plant pests across Ireland. Current models purely focus on forecasting pest-risk for a single season using an accumulative growing degree day model, for example https://www.usanpn.org/. However, this method is limited in its application for species with differing overwintering strategies. The inclusion of overwintering allows for the understanding of how climatic conditions will become more conducive for certain species where understanding issues such as the timing of emergence, the number of generations per year and the effect of milder winters. We are aiming to develop models which will forecast the seasonality of species that include the three main modes of overwintering (Quiescence, Obligate and Facultative Diapause) across multiple years (1961 : present). A future goal of the project is to incorporate future climate scenarios using projections from the TRANSLATE project for the Island of Ireland (present : 2050).

A list of species was generated from consultations with relevant stakeholders and from the list of high priority pests from the European Union. We are developing template models for six species based on their overwintering cycle and summaries of their seasonality. The long-term goal of this project is to have an open access web application that is available to be improved over time. In this presentation, I will give an overview of the process taken to develop our web application, overwintering and the summaries of various species.

Assessing the impact of *P. ramorum* to hybrid larch trees in Ireland

Laura Guillardin, PhD[1]; Niall Farrelly, PhD[1]

1: Teagasc Forestry Development Department, Teagasc

Japanese larch and European larch species have largely been affected by *Phytophthora ramorum* since its appearance in Ireland. However, there is a scarcity of studies looking at the level of tolerance or susceptibility of the hybrid larch towards this disease. Other studies have suggested that European larch may be more resistant to the pathogen, however, hybrid larch varieties produced in seed orchards may contain higher proportions of Japanese larch than European larch. Therefore, we aim to investigate the genetic makeup of the hybrids planted in three trial sites in Ireland that include trees from different sources. These sources include various geographic regions and are either pure European, pure Japanese or hybrid larch. Our hypothesis is that hybrids with maternal European genotypes may show higher levels of tolerance. To look into this, we will use molecular markers to identify the species and to define which type of hybrids exist in the trial sites. To confirm the presence of the fungus-like oomycete in the sites, we will place water containers and will use the *P. ramorum* LAMP detection kit. Finally, aerial images will be used to analyse the crown symptoms to assess the individual and species level of infection.

Using HTS to understand viral diversity in crops and potential viral reservoirs

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Plant viruses are known to be responsible for almost half of the emerging plant infectious diseases, posing a significant threat to agriculture worldwide. Even though understanding viral diversity is crucial for optimising disease management strategies, most of the plant virus research has focused on the limited number of viruses in specific crops, and there is only limited information available about viral diversity across Europe, with no survey carried out to date in Ireland.

In this study we are using high-throughput sequencing (HTS) to perform an untargeted survey of viruses, assessing their diversity across not only commercial crops (i.e. cereals, legumes, potatoes, and beets) but also investigating plant viruses in arable margins, which can act as virus reservoirs.

The output of the project will be the first national database of plant viral sequences, useful for the development of targeted diagnostics tools in support of IPM strategies. Awareness of viral diversity in both crops and wild plant communities indicates new directions in current strategies and provides valuable knowledge when assessing phytosanitary risk of potential or emerging threats, including understanding the role of crop viral reservoirs.

Identifying the impact of insecticide resistant grain aphids (*Sitobion avenae*) on barley yellow dwarf virus epidemiology in Ireland

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Resistance to pyrethroids in the English grain aphid (*Sitobion avenae*) has spread throughout Europe, including Ireland, since 2013. *S. avenae* that survive spray applications can cause damage to crops by feeding on the grain and by transmitting barley yellow dwarf viruses (BYDV). The 2018 EU-ban on neonicotinoids leaves pyrethroid applications as the remaining control option, and it has therefore been hypothesized that BYDV pressure will increase, because of the favourable selection of pyrethroid resistant *S. avenae* after spray applications. Given the potential agricultural impact, a three-year field study was conducted. The findings revealed a decline in the occurrence of insecticide-resistant *S. avenae,* and no link between aphid resistance and high BYDV levels was found. Furthermore, BYDV transmission experiments demonstrated that the resistant *S. avenae* clonal lineage is not a better BYDV transmitter than other susceptible *S. avenae* clones. However, virus-aphid behavioural manipulation experiments showed that BYDV-infected aphids exhibit increased movement activity, and that different BYDV species manipulate aphid behaviour in different ways. The results underscore the complex tripartite interactions between aphids, viruses, and crops, all of which influence BYDV epidemiology. This should be taken into account when developing future decision support tools.

Our History in Pests: Rescuing Data To Help Understand Ireland's Forestry Pests

Ultan Ó'Donnell

On the island of Ireland, extensive documentation of historic invasive pests and pathogens have been published by many different reporting bodies over the latter half of the 20th century, including but not limited to Ministerial Reports to the Dáil, Coillte Forestry Reports, Department of Agriculture Reports, and even SIPP Annual Meeting Reports. These documents have a wealth of information that could contextualise and inform scientific pursuits in entomology and plant pathology. Unfortunately, the passage of time has resulted in this information becoming difficult to access to the modern researcher, with many documents inaccessible by the public. We describe methods used to rescue data from annual forestry reports on the island, and develop a model from this information to understand how weather effects, control measures and surveillance efforts impact the recorded observations of invasive forestry species. The results provide evidence that multi-year systematic surveillance efforts have improved the detection of pest species before they have arrived and help prevent false absences of invaded species being recorded. We provide three recommendations to improve the usability of reported data to better understand observed pest dynamics going forward, in order to inform future studies on pest dynamics on the island of Ireland and abroad. The presentation will conclude with a call to action for the exploration of recently digitised records of the SIPP Annual Meeting Records.